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CLIMATIC CONDITIONS REQUIRED AND FACTORS AFFECTING THE PRODUCTION OF SWEET POTATO

CHAITALI CHAKRABORTY[1], RIYA DASGUPTA[2] & DEBJIT GHOSH[3]

[1,2]*Department of Food Technology, Guru Nanak Institute of Technology, Panihati, Sodepur, Kolkata, India*

[3]*Don-Limon GmbH, Hamburg, Germany*

ABSTRACT:

Sweet potato is a subtropical crop. It requires moderate temperature ranging between 21-26°C. It requires the average temperature 75°F (24°C) for growth. The other factor that also have significant effect on growth are abundant sunlight, warm nights,annual rainfall [(750-1000mm), with minimum range of 500mm in growing time]. Climate change such as global warming, elevated CO_2 concentration, high temperature etc affects sweet potato production worldwide. Elevated CO_2 cause malformation of tuber. High temperature also causes reduced yield. Overall climate change affects sweet potato greatly.

KEYWORDS: Climate Change, Production, Yield, Carbon-di-Oxide & Temperature

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Original Article

INTRODUCTION

Sweet potatoes can be grown where there is a long frost-free period with warm temperatures in the growing season. The plant does not tolerate frost .Sweet potato requires moderate temperature (21-26^{o}C, so, it can be grown in every month but in different countries worldwide. Sweet potatoes require plenty of sunshine, but shade causes yield reduction. However, sweet potato is intercropped with other seasonal crops like pigeon pea, maize, etc (Nedunchezhiyan *et al.*, 2010) and to fulfill the objective of intensification of crop and to gain the profit at a maximum level, it can be grown as an intercrop. At initiation stage (0-60) days, sweet potato is very much sensitive to draught and water-logging. If it is not maintained properly, then it causes rotting of tuber and reduced growth of storage root. (Nedunchezhiyan and Ray 2010). Sweet potato is very much affected by saline and alkaline condition of the soil. (Dasgupta *et al.* 2006, Mukherjee *et al*. 2006).

FACTORS AFFECTING THE PRODUCTION OF SWEET POTATO

Concentration of CO_2

Increased rates of photosynthesis, WUE, and NUE on plants grown at elevated CO_2 concentrations not only alter biomass, but also change the plants elemental composition. The majority of studies looking at these effects have focused on the foliar portion of crops, or the seed or grain of major global crops and resulted in increased carbohydrate concentration and decreased protein and mineral concentration (Seneweer and Conroy, 1997; Fangmeier et al., 1999; Prior et al., 1998). Loladze (2002) reviewed 25 studies that looked at changes in mineral concentration of plants grown under slightly elevated (twice ambient) CO2 concentrations. He found average percent decreases in N, P, K, Ca, S, Mg, Fe, Zn, Mn, and Cu for all foliar plants, and decreases for all minerals except K (.86% increase) and Cu (no data) for wheat showing the same trends found for wheat mineral

concentration in another study (Hogy *et al*., 2009a). Decreases in mineral concentration has been shown to be a result of dilution from greater incorporation of carbon-rich molecules (i.e., carbohydrates) instead of mineral incorporation (Porter et al., 1997; Fangmeier *et al*., 1997) and some minerals may also show decreased uptake due to lower transpiration under SECC (23% on average Kimball *et al*., 2002; Cure and Acock, 1986; Rogers and Dahlman, 1993) resulting in partial stomatal closure and lower rates of mass flow (Conroy and Hockling, 1993; Conn and Cochran, 2006). This study was the first of its kind to look at the changes in nutrient concentration from VECC on sweet potato storage roots. Due to increased level of CO_2 in the surroundings, silver lining and double sizing of sweet potato occurs. Hope Jahren at the University of Hawaii at Manao and colleagues grew the plants at four CO_2 concentrations: the current level of 390 parts per million, as well as 760, 1140 and 1520 ppm. The Intergovernmental Panel on Climate Change predicts that atmospheric CO_2 levels will be between 500 and 1000 ppm by the year 2100. For the least extreme scenario at 760 ppm, the team found the tubers grew up to 96 per cent larger. Crucially, previous studies revealed the protein content in wheat, rice, barley and sweet potatoes dropped by 15 per cent when grown under CO_2 levels double those of today.

Drought

Drought affects not only the growth and yield of sweet potato but also it affects the following factors such as

- Membrane integrity
- Availability of pigments
- Osmotic differences
- Water relationships
- Activity of photosynthesis

All the above factors are examined on sweet potato and stated by Praba *et.al* on 2009. Many physiological and biochemical reactions take place in the plant roots and stems. As a result, the changes of many growths related factors (plant nutrition, photo-synthesis, water relations, respiration, metabolism of nutrients and other growth promoting factors). Cell enlargement is inhibited by water stress. And it is more observed than cell division. The advantage of prolific system is to support high rate of plant growth during preliminary stages. Due to presence of such system in sweet potato, it becomes drought tolerant. But additional irrigation is needed for better sprouting and establishment. Due to water stress, low tugor pressure develops which accelerates inhibition of cell expansion and growth. For survival, cell tugor is maintained by osmotic regulation under extreme drought condition. Leaf growth is reduced by stress due to excess water. Biomass is diminished by water stress. Different cultivars respond different to reduced yield (Jaleel.*et.al*, 2008).

Temperature

Different temperature zone are required for the growth of the sweet potato. Growth of sweet potato means the growth and development of tuber and storage root. For the growth of both of them two different temperature are required. During nighttime temperature is lower than the day time. So, tuber formation is more favored during night time. Similarly, during day time, due to presence of the sunrays, temperature becomes higher. This favors the storage root development. All this are responsible for the production of sweet potato. Development of storage root is directly proportionate up to a certain range of temperature region, especially, up to 20°C. Above 20°C, the growth and development of storage root falls rapidly. Though temperature has a significant role on growth of storage root, it does not have important role on formation

of total root. On the other hand, its effect is only effective up to time required for the 50% development, increment of size and improvement of quality of storage root. It plays important role on the increment of total biomass (Van Dam *et al*., 1996). Between the temperatures range 27°-35°C, the increment of total biomass is in between 22- 30. Above that temperature range causes the declination from 11% (37°C) to 90% (42°C) (Somasundaram.*et.al*, 2008).

CONCLUSIONS

The Impact of Future Climate Change on Sweet Potato Production World Wide

The climate changes through worldwide are mainly caused by global warming and pollution. It includes the changes of CO_2 concentration and temperature and reduced water level. These factors are important for the production of the sweet potato Change of any one of the factors cause major declination in the yield and biomass. According to recent assessment, the global temperature will increase up to 2°C by increasing emissions of industries. Another factor which is also changed due to climate change is rainfall. Sweet potato is mainly cultivated in tropical and subtropical regions of USA, Africa and India. Due to heavy rainfall in USA (DeAngeli *et.al*, 2010), water logging may occur which greatly affect the storage root and tuber formation. Sometimes, excess rainfall may cause death of the plant and many bacterial attacks takes place as in this period, water content is more and water activity is more than0.9 and shrinkage may occur (Ton *et.al*, 1978). Reduced rainfall also affects the production. Reduced annual precipitation causes drought. Sweet potato is drought tolerant up to a certain limit. But, above the level, declination of productivity may take place (Jaleel.*et.al*, 2008)). As a result of this, tugor pressure lowers and cell division and expansion for growth lowers down. Overall, the climate change affects the sweet potato production worldwide and become detrimental for us.

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